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AAMTI
Proposal Number 2004011074
Incorporating New Technology to Create a Comprehensive Realistic Training Environment for the 91W.

I. Introduction:

Keywords
Medical Simulation
Hybrid Training
91W Transition
91W Sustainment
Combat Casualty Care

Abstract
The level of competence of the combat medic (91W) assigned to TOE units is varied and below the standard of civilian paramedics and Special Forces medics. These soldiers often have minimal clinical experience when assigned directly out of Advanced Individual Training (AIT). Operational constraints and additional "military duties" often limit the amount and quality of clinically relevant medical training. These soldiers often know more about vehicle maintenance and "Color Guard" responsibilities then the required skills of their primary mission, to conserve the fighting strength. When training does occur, it is often on individual subsets of knowledge and does not allow practice of these multiple skills together, in sequence or in a combined scenario with the medic's entire unit in tactical maneuvers. For example, IV skills, splinting, fluid management, tourniquet application, hemostatic dressing application, calling in a 9-line MEDEVAC request and searching an enemy casualty are rarely practiced at the same setting. If this does occur, it is usually only for JRTC and NTC rotations and lacks realism.

Our proposal is to incorporate medical simulation into a clinically and tactically relevant program for training combat medics deploying in support of the War on Terror. At the Madigan Army Medical Center's Andersen Simulation Center and Departments of Clinical Investigation and Surgery, we have over 2 years experience training soldiers from 91W's through physicians. To date we have trained over 3500 active and reserve component soldiers in clinical and tactical environments. We would like to use this experience to develop a comprehensive training environment that leverages new technologies and changes the training of the 91W in the US Army. Our goal is to incorporate short didactic sessions, immediate skills stations, case-based experiential learning in both simulation and live tissue models into a hybrid course for combat medics and all brigade medical providers from the combat life-saver to the FST surgeon. It consists of four major parts; didactics, task/skills stations, case-based scenarios from actual wartime environments and an FTX. The FTX portion is unique in that it can be performed by a group of battalion medics only, be incorporated into a brigade sized FTX to include FST and rotary winged evacuation or be a combination of any of the brigade medical assets. Champion and Higgins have defined the 'hybrid simulator,' i.e., one that incorporates a realistic human mannequin, including all the tactile procedural stimulus, with audio/visual feedback and

monitoring. Our course takes the 'hybrid' concept one step further and uses multi-modality training and stimulus/feedback from many forms to provide the ultimate learning environment.

No mannequin can simulate the massive uncontrolled hemorrhage from that of a proximal femoral artery injury much less the immediate feedback the medic has of applying a hemostatic dressing and being rewarded the immediate results of his action. Then again, there are few animal models available for simulating the physiologic results of bradycardia and hypertension of a closed head injury with impending herniation and the physiologic feedback that can be simulated. We currently are in an environment where standards and doctrine associated with medical and especially tactical field care are constantly changing. For example, the principles of low volume and hypotensive resuscitation are supplanting the PHTLS and ATLS protocols for fluid management. We developed a course curriculum covering the critical principles of combat casualty care. Topics currently include; Wound injury statistics, Mechanisms of Injury, Tactical Phases of Care, Patient Assessment, Triage, Airway Management, Shock, Hemorrhage Control, Fluid Resuscitation, Extremity Trauma, Abdominal/Thoracic Trauma, Burns, Head and Spinal Trauma, NBC, Caring for Civilians and Enemy Prisoners of War on the Battlefield and Team Training. Although good and constantly improving, today's simulators are not the same as live patients. Using an IRB/IACUC approved protocol, procedural skills will be trained on live animals in a controlled environment then during the FTX portion of the training. This FTX will attempt to bring in all the variables the 91W will encounter in a tactical environment. Their progress will be monitored and treatment documented by instructors.

See Proposal 2004011058 for a description of the entire program.

Our goal is to expand our previous training experience(Ref #1) into a large scale realistic training environment that uses the new technology of mannequin based medical simulation in conjunction with the more classic trauma teaching model of live animal models. The US military has spent large amounts of money to purchase simulators for medical training but they still are used most commonly in an artificial classroom environment. We plan to evaluate new simulation mannequins (wireless and pediatric physiology) and stress there capabilities with respect to the real military needs of field durability and mobility. In addition we plan on combining live tissue training to hopefully develop a model for all future training of military health care providers.

References

1. Rush, RM, Miller JP, Gibson SO, Koeller C, Kelly P, Sebesta JA, and Azarow KA. From buddy-aid to the forward surgical team: the Madigan Model for improving trauma readiness of brigade combat teams fighting the Global War on Terror. Presented at the 26th Annual Gary Wratten Surgical Symposium at Walter Reed Medical Center. Abstract to be published in the April or May 2005 issues of Current Surgery.

2. Champion HR, Higgins GA. Meta-analysis and planning of SIMTRAUMA: medical simulation for combat trauma. Technical report published Tech Med, INC, Annapolis MD, June 2000

Technology to Be Demonstrated

Technology to be demonstrated is multi-factorial. Our primary technology funding will be used to acquire medical simulators designed for trauma and medical procedures, to include physiologic monitoring and programming. We will then compare learning curves, both perceived and measured, of the simulator procedures to those of our live tissue model and then ultimately how they compare to wartime scenarios. This requires the use of pre and post training and post deployment questionnaires. We hypothesize that the hybrid model of combining trauma training through the use of short didactic sessions, case based scenarios, medical simulators and live tissue models is synergistic for combat medic training.

In addition, we will incorporate other newly developed medical technologies and procedures with the goal of not only putting the technology in the hands of the far-forward combat medic but also TRAINING him or her in how to use them with the most efficacy on the modern battlefield. Some of these include the application of hemostatic agents/dressings to stop seemingly uncontrollable hemorrhage, the use and application of the most modern tourniquet technology, procedures such as needle and tube cricothyroidotomy, and evacuation equipment and techniques.

With respect to the simulators millions of dollars have been spent by the US Army to acquire simulation mannequins for medical training. We also propose two new simulation technologies and compare them to currently used simulation mannequins. First we will purchase and evaluate/compare a new self contained wireless mannequin as well as a pediatric mannequins since currently deployed combat medics are required to care for wounded civilians on the battlefield as well as provide humanitarian care.

Significance/Uniqueness of the Demonstrated Technology and Supporting Literature Search

We are not aware of any other single course or training environment that concentrates everything that the combat medic has learned, teaches new techniques, and insures proficiency through this multi-modal, hybrid training concept. Live tissue labs have been done for Special Forces medics in the past; simulators have been used to train medics in CPR and BLS as well.

This course also acts as a platform to introduce new concepts, procedures, technology and equipment in a classroom and real-time environment and to test the efficacy of the products themselves as well as proposed training methods. For example, there is another FY05 AMTI proposal that looks at overlaying medical informatics on simulator based medical training.

Metrics to be used to Prove Efficacy

1. Pre and Post Tests on Didactic Knowledge.

2. Pre and Post Questionnaires on Usefulness of training, appropriateness, relevance.

3. Pre and Post Questionnaires focusing on the use of animals vs. simulation.

Our goal is to gain insight into the effect of these different teaching modalities and try to separate the core issues of efficacy and acceptance. Young soldiers may be excited about the "real blood

and guts" but when is it an effective tool for training, all the time or just once? What can simulation offer that didactics and live tissue models can't? How realistic does the training have to be to be effective?

4. Pre and post deployment questionnaires.

Pre-deployment questionnaires will be given at the end of the course. We are developing a mechanism to administer post-deployment questionnaires at the Fort Lewis SRP sites. Over the last six months we have developed a solid relationship with the deploying and redeploying units at Fort Lewis. MAMC is in continual contact with currently deployed members of the 1st/25th ID SBCT and the 54th Air Ambulance Company to collect information on the current issues those units are facing and adapting the training program to better fit the needs of the medics and units we serve.

5. Simulator specific:

We will develop a measurement tool that looks at the capabilities of the mannequins and evaluates ease of use, durability, portability and soldier acceptance.

Military Relevance

Today's US Army tactics are focused on the brigade combat team (BCT). The scope of medical providers assigned to these teams range from the combat medic (91W) assigned to line units, to the battalion surgeons (physician's assistant or doctor) and medics at the battalion aid station, to the doctors, medics and nurses assigned to the brigade aid station to the surgeons, anesthetists, nurses and medics on forward surgical teams (FST) that co-locate with the brigade aid stations at times of intense fighting. This project focuses primarily on medical care provided by the 91W in multiple clinical and tactical environments. These environments: Sick Call, Trauma, Triage, Combat (Care under Fire, Tactical Field Care & CASEVAC care) and the documentation of that care are the primary missions of the 91W. In addition, we encourage all medical personnel assigned at brigade level and lower, to include FST personnel, to attend the course.

The procedural skills essential to management of tactical casualties are described in short but focused didactic sessions trained and tested on simulation task trainers. These skills, taken from Table 8 of STP 8-91W15-SM-TG Soldier s Manual and Trainer s Guide, MOS 91W, will also address some of the issues associated with 91W transition and sustainment.

Madigan Army Medical Center is a unique center and best suited for this training. It is a modern military medical center that is co-located with 6 conventional maneuver brigades (3 reserve), the 1st Special Forces Group, the 2nd Ranger Battalion, 2 corps support groups (one reserve), the national ROTC advanced camp training brigade and training site, and multiple other units. In the Western Region, there are numerous other units, both active and reserve that are poised to benefit from this training. Two remote units have already sent medics through the course, the 11th ACR from Fort Irwin and the Alaska Stryker Brigade from Fort Wainwright. Madigan itself has endless relationships with these units. Adding to the benefit are the numerous training

programs and research initiatives provided by a robust Graduate Medical Education Program, Clinical Investigation Division, and NCO development courses.

We are developing a strong relationships with individual units as well as people like Mr Greg Rathburn at the Lessons Learned Section of the AMEDDC&S to make our training as real world relevant as possible.

Infrastructure, Equipment, Personnel and Subjects that would have to be acquired

Simulators:

The ASC currently has Laerdal SimMan Mannequins to represent the current state of technology. We have opted not to purchase/request the other main vendor's mannequin (ECS, Meti) due to no significant difference in technology with respect to the primary investigator. Additionally this mannequin lacks an army approved air worthiness statement and is almost 2 times more expensive then a similarly equipped Laerdal Mannequin. We are requesting to purchase mannequins that represent the two new areas of technology a wireless self contained adult mannequin as well as an infant mannequin.

Computer/Video Hardware/Software:

The ASC has robust video capture capabilities for unit/soldier evaluation at their stationery facility however a large portion of the training is done at the field site and we lack portable video camera equipment as well as editing hardware and software to develop teaching aids and visual feedback for the students.

Personnel:

Competent stable medical trainers have been a major issue for this program but especially for the Andersen Simulation Center. We are requesting a part time FTE to augment the training staff. This individual will assist with data collection and the research aspects of this program. This partial FTE will be combined with any other funded partial FTEs from the Andersen Simulations Centers proposal. We will combine the funded monies to hire 1-2 FTE (depending on the number of proposals awarded) and leverage off each other to maximize economy of force in the staffing of these protocols.

Expected Time from Award to Work Commencement

Course in basic format already in place. Lecture plans complete. Data Collection and evaluation of new equipment to begin upon arrival of equipment (45 Days). Robust development of questionnaires depends on unit deployment and redeployment schedules. Hiring actions will begin as soon as money is awarded.

Internal Review Board (IRB) Protocol

MAMC already has an IRB/IACUC approved animal use protocol for trauma training. When appropriate to the training (i.e. prior to deployment, following demonstration of appropriate knowledge and technical skills animal patients will be incorporated into the scenario based

phases of the training program. Soldiers will have to sign a consent form documenting their desire to participate in the animal phase of the protocol and will also document their acceptance of confidentiality issues related to the protocol (e.g. no picture taking, no discussion outside of unit, etc). MAMC also has an ongoing protocol for the use of medical simulation training. As the questionnaires are developed they will be approved through amendment of the existing IRB protocol.

IMO/Commander Concurrence/Approval

BG Dunn the Commander of the Western Regional Medical Command and Madigan Army Medical Center is in full support of the training and research mission of the Andersen Simulation Center as well as the Departments of Surgery and Clinical Investigation. His vision is to create a world-class simulation and education center (A Stryker Center of Medical Excellence) where new medical technologies can be brought to the front lines as well as providing high quality useful medical training for today's AMEDD soldiers. He has been briefed on this proposal and supports its implementation.

II. Final Report

A. Overview:

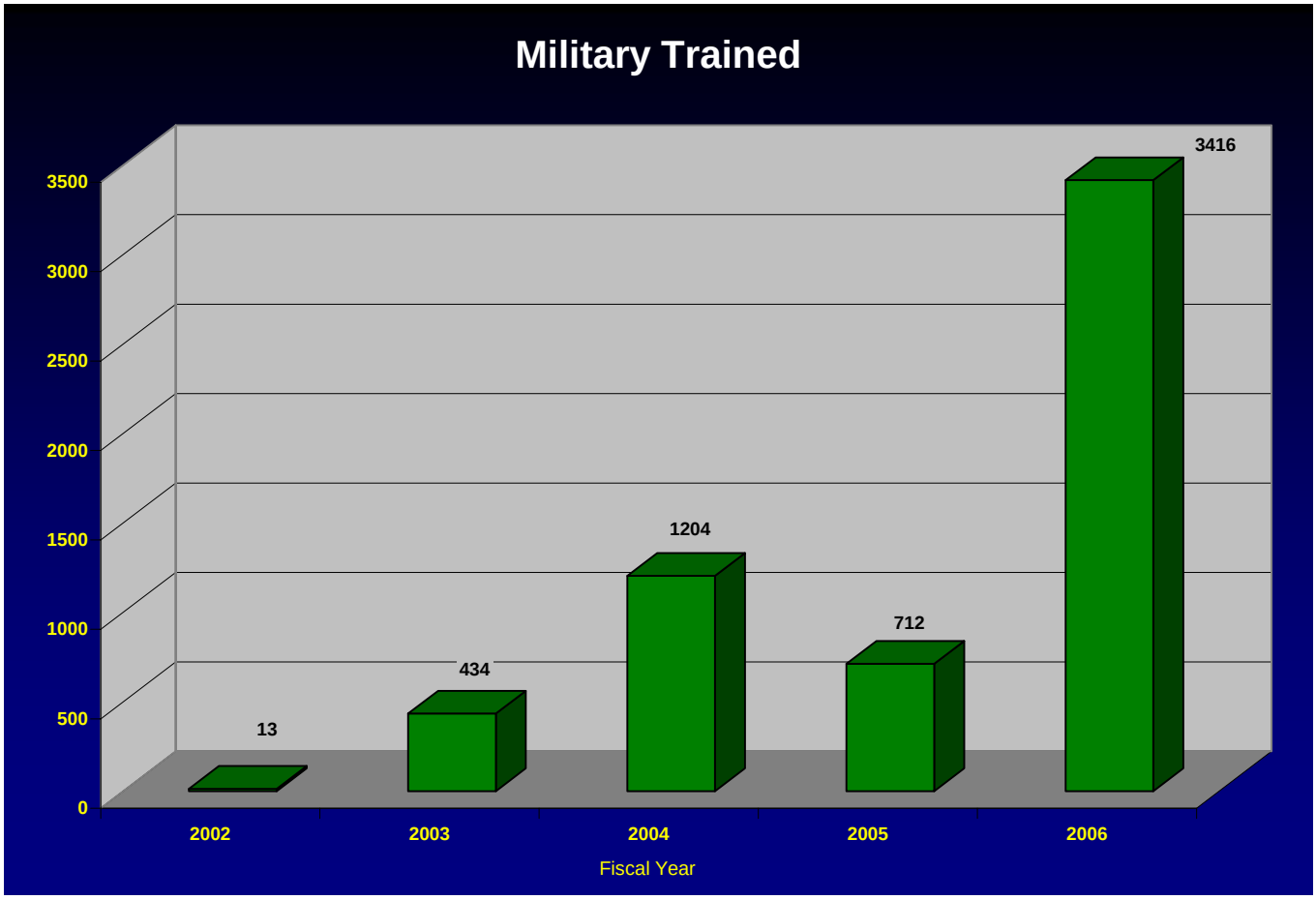
In all, we believe we were able to show that this type of simulation and hybrid training is both needed and highly desired. The courses we put on have contributed to the development of the Medical Simulation Training Centers currently being placed at key military training centers around the world. In addition, the AMEDD center and school is now offering a live tissue training course for medics and is beginning to deploy it to other sites.

We were able to summarize our program into a manuscript that has been accepted for publication and is currently in Press in the Journal of Surgical Research.

JSR-D-06-000911 Draft.MDI

B. Numbers Trained. Both military specific and hospital based training occurs at the Andersen Simulation Center. Cumulative data followed by the military specific training data will be presented in the following charts and graphs. Equipment purchased for the AAMTI project was also used for hospital based training and did have an input on the amount of training performed at the Andersen Simulation Center. 2002 data starts in Jun of 2002. 2006 data ends 15 August 2006

The above chart depicts the total number of people trained at the Anderson Simulation Center by Fiscal Year. Equipment purchased through the AAMTI proposal allowed for the large increase in 2006 trainees.

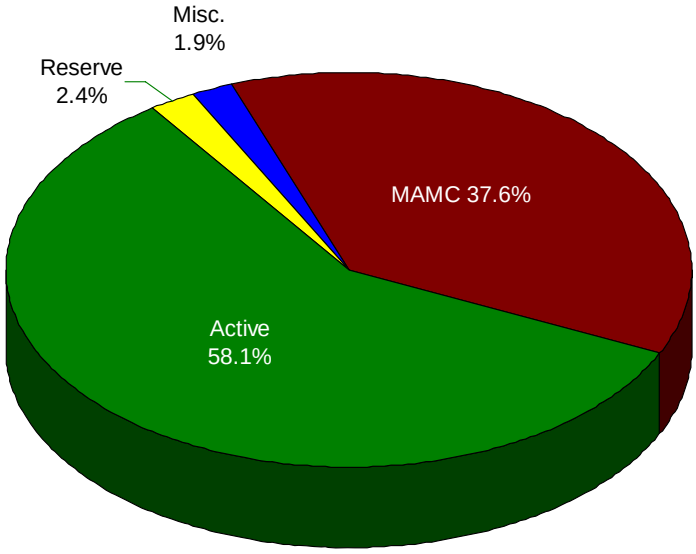


As seen above, programs put in place have allowed for a marked increase in the number of soldiers trained in 2006. This chart does not include training performed at Madigan Army Medical Center as part of Graduate Medical Education or hospital specific training programs. Fort Lewis is one of the 4 initial sites for a Medical Simulation Training Center. The MSTC is conducting the majority of required Tactical Combat Casualty Care (TC3) training as part of the 91W transition and sustainment programs. These changes have lead to changing the direction of our programs. We have branched out into command directed training. This allows us to focus on requirements the unit's command sees as a need but does not necessarily follow all of the requirements of a AMEDD C&S sponsored course. We are training to the same standard but not through the same POI.

In addition the largest increases in our training population have been as part of the Combat Lifesaver programs. We have placed training environments into other programs at Fort Lewis. For example, While units are conducting DARWARS simulation training at Fort Lewis, soldiers are broken off during slow times and given classes and experience with combat lifesaver skills on mannequins. This program is seeing tremendous success. It doesn't alter the effectiveness of the combat training and increases soldier's acceptance by cutting down "dead-time".

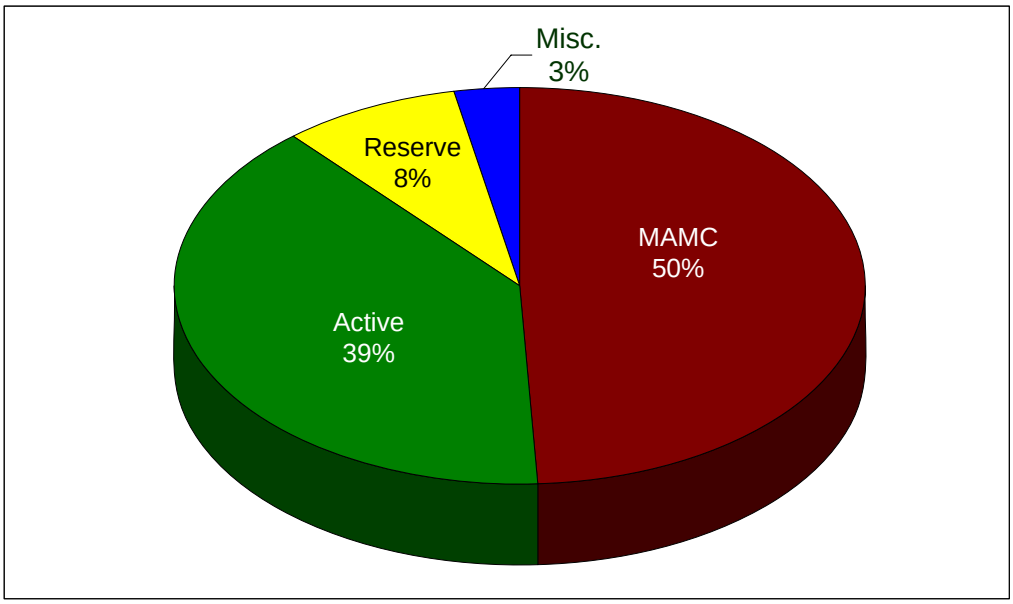
By leveraging these trainings of opportunity we have pushed medical simulation training into areas where it was not seen in the past. Starting with the 2008 POI for Fort Lewis' WLDC Warrior Leader Development Course (formerly know as PLDC, Platoon Leaders Development Course) a medical simulation program will be placed into the formal instruction.

Patient Based Simulation Training FY 2006



The majority of personal trained by the ASC in FY 2006 are from the active and reserve component units associated with Fort Lewis.

Patient Based Simulation Training FY 2002-2006



This marked growth has made a hospital based simulation center with a primary focus of GME training to have near 50-50 training requirement of military and hospital training.

C. **Simulator Review**

Until recently the primary simulation mannequin used by the military was the Laerdal SimMan. The ASC had 6 SimMen prior to this program. We chose to evaluate two additional products the Guammard Medical Hal and Laerdal's ALS Mannequin. The two other major vendors at the time were Simulaids PDA stat and Meti's ECS (emergency Care Simulator). In my opinion the PDA stat although cheap in comparison ($8K vs $20-50K) did not have the capabilities or realism needed to participate. The Meti product has different software and functionality from the SimMan but is essentially the same type of mannequin still tethered to accessory equipment that makes it's use in the field seriously limited.The enclosed clip demonstrates the limitation of a tehthered system. This unit did not have intrinsic stretchers at this level of care and the technician was obviously in the way.

Lancer Summit320

The ALS mannequin had the obvious benefit of a much smaller price tag ($8K)but it also showed many problems with mobile training and never was able to catch on with the units.

The Guamard HAL has the obvious benefit of being a tetherless system. In addition the company was willing to work with us to develop trauma specific modules.

These modules had internal blood bladders and required proper tourniquet application to stop bleeding. The problem with the Guamard Mannequin was that it was a new product. Reliability was a major issue. During the course of the project numerous improvements were made and reliability improved but history and preference seriously impaired its ability to excel.

D**. Medical Documentation**

Our initial Goal was to develop a series of simulated patients and medical records to train both the medial care and documentation skills with the BMIST handheld and CHCS-IIT modules. We were unable to develop a usable model for this portion of the protocol. Failure was contributed to by units failing to show actual interest despite voicing initial approval, and an inability to obtain CHCS-IIT hardware and software.

E**. Pediatric Simulation**

We were unable to get a pediatric training program for medics off the ground. The units did not show a great deal of interest in pediatric care for humanitarian aid. The ones who had some interest were not able to dedicate adequate time for the program.

F. Conclusion

I believe our initial premise was correct. Realistic training is both needed and wanted by soldiers. The difficulty in actually performing this training is an impression by the individual soldier that live tissue is the only thing worthwhile. Slowly these preconceptions are changing but still the prerequisites must be completed prior to live tissue training. The development of the MSTCs and now a AMEDD Live Tissue course caused us to change our objectives during the program period. We focused on areas that were not being met. We tried to push the mannequins into the field but still the units are resistant. I believe the army is still missing the picture when it comes to medical training.

Through the MSTCs and other programs the Army is showing marked improvements in the training of individual skills but still we **do not** have a reliable method of testing individual skills in a collective environment. Whether a medic can or can't treat a pneumothorax is unimportant if we can't get the medic to the patient or the patient to a medic while in a convoy under fire. I believe that until these type of programs are put in place we will not be completing our mission.